

# Epidemiology and economic burden of osteoporosis in Switzerland

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## Abstract

**Summary** This report describes the epidemiology, economic burden and treatment of osteoporosis in Switzerland.

**Introduction** Osteoporosis is characterized by reduced bone mass and disruption of bone architecture, resulting in increased risks of fragility fractures which represent the main clinical consequence of the disease. Fragility fractures are associated with substantial pain and suffering, disability and even death for the affected patients and substantial costs to society. The aim of this report is to describe the epidemiology and economic burden of fragility fractures as a consequence of osteoporosis in Switzerland, as a detailed addition to the report for the European Union (EU27): “Osteoporosis in the European Union: Medical Management, Epidemiology and Economic Burden”.

**Methods** The literature on fracture incidence and costs of fractures in Switzerland was reviewed and incorporated into a model estimating the clinical and economic burden of osteoporotic fractures in 2010. Furthermore, data on sales of osteoporosis treatments and the population at high risk of

fracture were used to estimate treatment uptake and treatment gap.

**Results** It was estimated that approximately 74,000 new fragility fractures were sustained in Switzerland in 2010, comprising 14,000 hip fractures, 11,000 vertebral fractures, 13,000 forearm fractures and 36,000 other fractures (i.e. fractures of the pelvis, rib, humerus, tibia, fibula, clavicle, scapula, sternum and other femoral fractures). The economic burden of incident and previous fragility fractures was estimated at CHF 2,050 million for the same year. Incident fractures represented 76 % of this cost, long-term fracture care 21 % and pharmacological prevention 3 %. Previous and incident fractures also accounted for 24,000 quality-adjusted life years (QALYs) lost during 2010. When accounting for the demographic projections for 2025, the number of incident fractures was estimated at 98,786 in 2025, representing an increase of 25,000 fractures. Hip, clinical vertebral (spine), forearm and other fractures were estimated to increase by 4,900, 3,200, 3,500 and 13,000, respectively. The burden of fractures in terms of costs (excluding value of QALYs lost) in Switzerland in 2025 was estimated to increase by 29 % to CHF 2,642 million. Though the uptake of osteoporosis treatments increased from 2001, the proportion of patients aged 50 or above who received treatment remained at low levels in the past few years. The majority of women at high fracture risk do not receive active treatment.

**Conclusions** In spite of the high cost of osteoporosis, a substantial treatment gap and projected increase of the economic burden driven by an aging population, the use of pharmacological prevention of osteoporosis is significantly less than optimal, suggesting that a change in health care policy concerning the disease is warranted.

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**Table 1** Population at risk: men and women over the age of 50 years in Switzerland, 2010 [8]

Age (years)	Women	Men	All
50–59	556,000	545,000	1,101,000
60–69	477,000	435,000	912,000
70–79	351,000	275,000	626,000
80–89	238,000	116,000	354,000
80+	276,000	126,000	402,000
50+	1,660,000	1,381,000	3,041,000

## Introduction

Osteoporosis is characterized by reduced bone mass and disruption of bone architecture, resulting in increased risks of fragility fractures which represent the main clinical consequence of the disease. Fragility fractures are associated with substantial pain and suffering, disability and even death for the affected patients and substantial costs to society. The aim of this report was to characterize the economic burden of osteoporosis in Switzerland in 2010 and beyond.

## Methods

The literature on fracture incidence and costs of fractures in Switzerland was reviewed and incorporated into a model estimating the clinical and economic burden of osteoporotic fractures in 2010. Details of the methods used are found in Chapters 3 and 4 of the report “Osteoporosis in the European Union: Medical Management, Epidemiology and Economic Burden” [1], published in 2013 in *Archives of Osteoporosis*.

## Epidemiology of osteoporosis in Switzerland

For the purpose of this report, the population at risk of osteoporosis was considered to include men and women  $\geq 50$  years. The number of men and women  $\geq 50$  years of age amounted to

**Table 2** Estimated number of women and men with osteoporosis (defined as a T-score  $\leq -2.5$  SD) in Switzerland by age using female-derived reference ranges at the femoral neck, 2010 [9]

Age group (years)	Women	Men
50–54	19,026	7,525
55–59	24,384	8,540
60–64	34,320	12,992
65–69	47,874	15,614
70–74	54,684	12,636
75–79	58,125	11,639
80+	130,272	20,916
50+	368,685	89,862

**Table 3** Incidence per 100,000 person years of hip, clinical vertebral, forearm and other fractures in Switzerland by age

Age (years)	Fracture at the			
	Hip	Vertebra	Forearm	Other
Women				
50–54	17	113	319	110
55–59	54	76	232	471
60–64	67	328	743	259
65–69	139	157	485	475
70–74	247	260	718	700
75–79	473	721	759	996
80–84	1,169	1,635	1,449	1,987
85+	2,937	1,390	1,135	4,933
Men				
50–54	35	89	132	155
55–59	76	156	158	710
60–64	65	262	130	643
65–69	135	187	173	873
70–74	139	299	69	714
75–79	326	223	191	869
80–84	363	799	95	964
85+	1,394	482	484	4,036

1,381,000 and 1,660,000, respectively, in Switzerland in 2010 (Table 1).

In the population at risk, the number of individuals with osteoporosis—as defined by the WHO diagnostic criteria applied to the femoral neck—was estimated at 460,000 (Table 2). There were 20.8 DXA units/million inhabitants, and guidelines for the assessment and treatment of osteoporosis are available [2]. A country-specific FRAX model

**Table 4** Estimated number of incident fractures in Switzerland, 2010

Age (years)	Fracture at the				All fractures
	Hip	Vertebra	Forearm	Other	
Women					
50–74	1,735	2,697	6,305	6,460	17,197
75+	8,886	4,871	4,528	16,092	34,376
Total	10,621	7,568	10,833	22,552	51,573
Men					
50–74	1,233	2,306	1,588	8,205	13,333
75+	1,980	1,089	693	5,523	9,286
Total	3,213	3,395	2,282	13,729	22,619
Men and women					
50–74	2,968	5,002	7,893	14,665	30,529
75+	10,866	5,960	5,221	21,615	43,663
Total	13,834	10,963	13,115	36,280	74,192

**Table 5** Proportion of men and women (in %) with a prior hip or clinical vertebral fracture in Switzerland, 2010

Age (years)	Hip fracture	Vertebral fracture
Women		
50–54	0.0	0.2
55–59	0.2	0.6
60–64	0.5	1.5
65–69	1.0	2.3
70–74	1.9	3.1
75–79	3.5	5.0
80–84	6.6	8.7
85+	15.8	14.0
Men		
50–54	0.1	0.2
55–59	0.3	0.8
60–64	0.6	1.5
65–69	1.0	2.2
70–74	1.6	2.7
75–79	2.5	3.2
80–84	3.9	4.4
85+	8.5	6.0

is also available for the assessment of fracture risk (<http://www.shef.ac.uk/FRAX/>).

Data on the incidence of hip, vertebral and forearm fractures are available for Switzerland [3]. The incidence for “other” fractures was derived as described in the EU27 report [1] (Table 3).

The number of incident fractures in 2010 was estimated at 74,000 (Table 4). Incident hip, clinical spine, forearm and other fractures were estimated at 14,000, 11,000, 13,000 and 36,000, respectively. Seventy percent of fractures occurred in women.

**Table 6** Number of men and women in Switzerland with a prior hip or clinical vertebral fracture after the age of 50 years, 2010

Age (years)	Hip fracture	Vertebral fracture
Women		
50–74	8,187	17,256
75+	36,424	39,174
Total	44,611	56,430
Men		
50–74	7,134	14,881
75+	9,936	9,943
Total	17,070	24,823
Men and women		
50–74	15,320	32,137
75+	46,360	49,116
Total	61,680	81,253

**Table 7** Incidence (per 100,000) of causally related deaths in Switzerland within the first year after fracture (adjusted for comorbidities), 2010

Age (years)	Hip	Clinical vertebral	Other fracture
Women			
50–54	397	516	10
55–59	641	788	19
60–64	842	978	27
65–69	1,056	1,157	40
70–74	1,416	1,461	64
75–79	1,740	1,681	109
80–84	1,985	1,757	221
85–89	2,637	2,050	462
90+	3,011	1,698	1,047
Men			
50–54	1,163	1,396	18
55–59	1,523	1,731	31
60–64	1,808	1,945	49
65–69	2,115	2,146	76
70–74	2,569	2,446	116
75–79	3,275	2,904	194
80–84	4,320	3,508	363
85–89	6,261	4,576	676
90+	10,422	6,782	1,304

A prior fracture was defined as a fracture in an individual who was alive during the index year (i.e. 2010) and which had occurred after the age of 50 years and before 2010. In the population  $\geq 50$  years of age, the proportion of individuals who had suffered a fracture prior to 2010 was estimated at 2.0 % for hip and 2.7 % for clinical vertebral fractures. The estimated proportions of men and women with prior hip and vertebral fractures by age are presented in Table 5.

**Table 8** The number of deaths in men and women in Switzerland in the first year after fracture attributable to the fracture event (causally related), 2010

Age (years)	Fracture at the		
	Hip	Vertebra	Other
Women			
50–74	21	32	3
75+	210	85	113
Total	231	117	116
Men			
50–74	27	49	6
75+	124	43	43
Total	151	91	49
Men and women			
50–74	49	81	9
75+	334	127	156
Total	383	208	165

**Table 9** One-year costs for relevant pharmaceuticals in Switzerland, 2010 [10]

	Annual drug cost (CHF)
Alendronate	469
Risedronate	667
Ibandronate	489
Zoledronic acid	421
Raloxifene	629
Teriparatide	6,376

**Table 10** Cost of osteoporosis (CHF) in Switzerland by age in men and women, 2010

Age (years)	First year fracture cost	Long-term disability costs	Fracture prevention cost	Total cost
<b>Women</b>				
50–74	296,616,249	37,600,533	32,270,586	366,487,368
75+	808,643,124	265,894,082	20,381,780	1,094,918,986
All	1,105,259,373	303,494,615	52,652,366	1,461,406,355
<b>Men</b>				
50–74	253,595,483	38,772,184	5,137,307	297,504,974
75+	206,776,516	81,831,119	2,264,754	290,872,389
All	460,371,999	120,603,303	7,402,061	588,377,364
<b>Women and men</b>				
50–74	550,211,732	76,372,717	37,407,893	663,992,343
75+	1,015,419,641	347,725,201	22,646,534	1,385,791,376
All	1,565,631,372	424,097,919	60,054,427	2,049,783,718

**Table 11** Total cost (CHF) in 2010 by fracture site in men and women in Switzerland. Note that costs for fracture prevention, therapy and monitoring are not included

Age (years)	Hip	Spine	Forearm	Other	All
<b>Women</b>					
50–74	100,985,955	54,536,166	48,202,428	130,492,233	334,216,782
75+	572,595,695	122,545,405	71,858,711	307,537,396	1,074,537,207
All	673,581,650	177,081,571	120,061,140	438,029,629	1,408,753,989
<b>Men</b>					
50–74	82,322,724	45,552,418	11,995,901	152,496,625	292,367,667
75+	144,371,747	23,210,565	12,025,998	108,999,327	288,607,635
All	226,694,470	68,762,983	24,021,898	261,495,951	580,975,303
<b>Women and men</b>					
50–74	183,308,679	100,088,584	60,198,329	282,988,858	626,584,449
75+	716,967,441	145,755,969	83,884,709	416,536,723	1,363,144,842
All	900,276,120	245,844,553	144,083,038	699,525,580	1,989,729,291

In the population over 50 years of age, the number of individuals with hip and vertebral fractures that occurred before 2010 was estimated at 62,000 and 81,000, respectively (Table 6). Note that fractures sustained in 2010 were not included in the estimate.

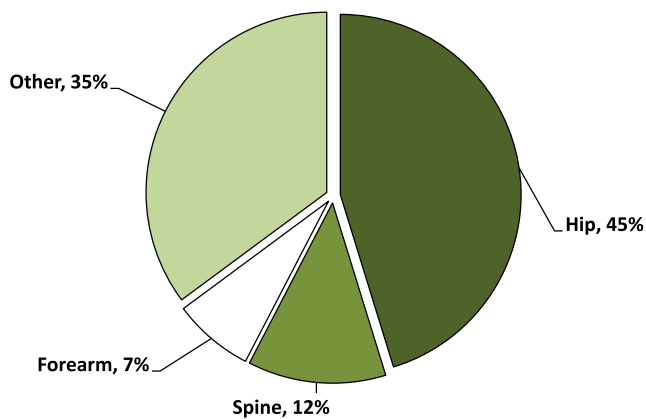
The incidence of causally related deaths (per 100,000) in the first year after fracture by age is presented in Table 7. The number of causally related deaths in 2010 was estimated at 756 (Table 8). Hip, vertebral and other fractures accounted for 383, 208 and 165 deaths, respectively. Overall, approximately 61 % of deaths occurred in women.

### Cost of osteoporosis in Switzerland including and excluding value of QALYs lost

For the purpose of this report, the cost of osteoporosis in 2010 (excluding value of QALYs lost) was considered to consist of three components: (i) cost of fractures that occurred in 2010 (“first year costs”), (ii) cost of fractures sustained prior to year 2010 but which still incurred costs in 2010 (“long-term disability cost”) and (iii) cost of pharmacological fracture prevention including administration and monitoring costs (“pharmacological fracture prevention costs”). See Chapter 4 of the EU27 report [1] for further details.

In Switzerland, the costs of hip, vertebral and wrist fractures have been estimated to range from CHF 34,374 to 38,871, CHF 19,790 to 36,622 and CHF 7,000 to 25,454 depending on age, respectively [4]. One Swiss franc (CHF) corresponds to 0.82 euro. Costs for other fractures were estimated as described in Chapter 4 of the EU27 report [1].

Long-term disability costs were estimated by multiplying the yearly cost of residing in a nursing home (CHF



**Fig. 1** Share (%) of fracture cost by fracture site in Switzerland. Note that costs for fracture prevention therapy and monitoring are not included

74,294 [5]) with the simulated number of individuals with prior fractures that had been transferred to a nursing home due to the fracture.

Annual drug costs (CHF) for individual treatments are shown in Table 9. In addition, it was assumed that patients on treatment made an annual physician visit costing CHF 91

**Table 12** Number of QALYs lost due to fractures during 2010 in men and women in Switzerland according to age

	Age (years)		
	50–74	75+	50+
<b>Women</b>			
Incident hip fractures	415	1,832	2,247
Incident vertebral fractures	892	1,403	2,294
Incident forearm fractures	222	138	360
Incident other fractures	772	1,652	2,425
Prior hip fractures	1,282	4,872	6,154
Prior vertebral fractures	966	1,888	2,853
Total	4,549	11,785	16,334
<b>Men</b>			
Incident hip fractures	299	471	770
Incident vertebral fractures	762	347	1,110
Incident forearm fractures	56	23	78
Incident other fractures	973	627	1,600
Prior hip fractures	1,114	1,470	2,584
Prior vertebral fractures	826	526	1,351
Total	4,029	3,464	7,493
<b>Men and women</b>			
Incident hip fractures	714	2,303	3,017
Incident vertebral fractures	1,654	1,750	3,404
Incident forearm fractures	278	161	438
Incident other fractures	1,745	2,279	4,025
Prior hip fractures	2,395	6,343	8,738
Prior vertebral fractures	1,792	2,413	4,205
Total	8,578	15,249	23,827

**Table 13** Value of lost QALYs (CHF) in men and women in Switzerland in 2010

	1 × GDP/ capita	2 × GDP/ capita	3 × GDP/ capita
Incident hip fractures	205,296,216	410,592,432	615,888,648
Incident vertebral fractures	231,621,487	463,242,975	694,864,462
Incident forearm fractures	29,830,907	59,661,814	89,492,721
Incident other fractures	273,829,405	547,658,810	821,488,215
Prior hip fractures	594,528,606	1,189,057,213	1,783,585,819
Prior vertebral fractures	286,101,039	572,202,078	858,303,117
Total	1,621,207,660	3,242,415,321	4,863,622,981

[5] and a DXA scan costing CHF 75 [5] every second year to monitor treatment. The cost of osteoporosis in 2010 was estimated at CHF 2,050 million (Table 10). First year costs, subsequent year costs and pharmacological fracture prevention costs amounted to CHF 1,566 million, CHF 424 million and CHF 60 million, respectively. It is notable that pharmacological fracture prevention costs amounted to only 2.9 % of the total cost.

When stratifying costs of osteoporosis by fracture type, hip fractures were the most costly (CHF 900 million) followed by other fractures (CHF 700 million), spine fractures (CHF 246 million) and forearm fractures (CHF 144 million) (Table 11

**Table 14** Population projections in Switzerland by age and sex [11]

	Population			
	2010	2015	2020	2025
<b>Women</b>				
50–59	556,000	646,000	689,000	642,000
60–69	477,000	481,000	536,000	624,000
70–79	351,000	402,000	425,000	433,000
80–89	238,000	220,000	235,000	275,000
90+	38,000	59,000	66,000	66,000
<b>Men</b>				
50–59	545,000	642,979	688,000	633,000
60–69	435,000	443,000	501,000	597,000
70–79	275,000	324,000	350,000	362,000
80–89	116,000	129,000	151,000	185,000
90+	10,000	17,000	24,000	28,000
<b>All</b>				
50–59	1,101,000	1,288,979	1,377,000	1,275,000
60–69	912,000	924,000	1,037,000	1,221,000
70–79	626,000	726,000	775,000	795,000
80–89	354,000	349,000	386,000	460,000
90+	48,000	76,000	90,000	94,000
	3,041,000			3,845,000

**Table 15** Projected annual number of incident fractures in 2010 and 2025 by fracture site and age in men and women in Switzerland

	Hip		Spine		Forearm		Other	
	2010	2025	2010	2025	2010	2025	2010	2025
<b>Women</b>								
50–74	1,735	2,127	2,697	3,344	6,305	7,814	6,460	7,938
75+	8,886	11,530	4,871	6,121	4,528	5,687	16,092	20,897
All	10,621	13,657	7,568	9,466	10,833	13,501	22,552	28,834
<b>Men</b>								
50–74	1,233	1,575	2,306	2,974	1,588	1,994	8,205	10,669
75+	1,980	3,463	1,089	1,712	693	1,153	5,523	9,786
All	3,213	5,038	3,395	4,686	2,282	3,148	13,729	20,456
<b>Women and men</b>								
50–74	2,968	3,702	5,002	6,318	7,893	9,808	14,665	18,607
75+	10,866	14,994	5,960	7,834	5,221	6,841	21,615	30,683
All	13,834	18,695	10,963	14,151	13,115	16,649	36,280	49,290

and Fig. 1). Please note that costs for pharmacological fracture prevention were not included given that they could not be allocated to specific fracture sites.

The number of quality-adjusted life years (QALYs) lost due to osteoporosis in 2010 was estimated at 23,827 (Table 12). Prior fractures accounted for 54 % of the total loss and 69 % of the loss occurred in women. The monetary value of a QALY was varied between one and three times the gross domestic product (GDP) per capita set at CHF 68,040. Assuming a QALY is valued at two times the GDP/capita, the total cost of the QALYs lost was estimated at CHF 3.24 billion (Table 13).

When the cost of osteoporosis was combined with the value of QALYs lost (valued at  $2 \times \text{GDP}$ ), the cost of osteoporosis amounted to CHF 5.3 billion in Switzerland in 2010. Incident fracture, prior fracture, pharmacological fracture

prevention and value of QALYs lost accounted for 30, 8, 1 and 61 %, respectively.

### Economic burden of osteoporosis up to 2025

The population above 50 years of age is expected to increase from 3.0 million in 2010 to 3.8 million in 2025, corresponding to an increase of 26 % (Table 14). The total number of fractures was estimated to rise from 74,000 in 2010 to 99,000 in 2025 (Table 15), corresponding to an increase of 33 %. Hip, clinical spine, forearm and other fractures increased by 4,900, 3,200, 3,500 and 13,010, respectively. The increase in the number of fractures ranged from 27 to 36 %, depending on

**Table 16** Current and future cost of (CHF 000,000) osteoporosis (excluding value of QALYs lost) by age and calendar year in men and women in Switzerland

	2010	2015	2020	2025
<b>Women</b>				
50–74	366	396	415	444
75+	1,095	1,167	1,250	1,353
All	1,461	1,563	1,665	1,797
<b>Men</b>				
50–74	298	324	348	377
75+	291	339	401	468
All	588	663	749	845
<b>Women and men</b>				
50–74	664	719	763	821
75+	1,386	1,506	1,651	1,821
All	2,050	2,226	2,414	2,642

**Table 17** Projected QALYs lost due to incident and prior fractures for the year 2010 and 2025 by age in men and women in Switzerland

	Incident fractures		Prior fractures		All fractures	
	2010	2025	2010	2025	2010	2025
<b>Women</b>						
50–74	2,301	2,839	2,248	2,459	4,549	5,298
75+	5,025	6,430	6,760	7,544	11,785	13,974
All	7,327	9,269	9,007	10,003	16,334	19,271
<b>Men</b>						
50–74	2,090	2,696	1,939	2,254	4,029	4,950
75+	1,468	2,517	1,996	2,724	3,464	5,241
All	3,558	5,213	3,935	4,978	7,493	10,191
<b>Women and men</b>						
50–74	4,391	5,535	4,187	4,713	8,578	10,248
75+	6,494	8,947	8,756	10,268	15,249	19,215
All	10,885	14,482	12,943	14,981	23,827	29,463



**Table 18** Present and future cost (CHF 000,000) of fracture (direct cost and cost of QALYs) by age and calendar year in men and women in Switzerland assuming the uptake of treatment remains unchanged

	2010	2015	2020	2025
Women				
50–74	985	1,048	1,096	1,165
75+	2,699	2,858	3,032	3,255
All	3,684	3,906	4,129	4,419
Men				
50–74	846	906	972	1,051
75+	762	858	999	1,181
All	1,608	1,764	1,971	2,232
Women and men				
50–74	1,831	1,954	2,068	2,216
75+	3,461	3,716	4,032	4,436
All	5,292	5,670	6,100	6,652

the fracture site. The increase was estimated to be particularly marked in men (47 %) compared to women (27 %). It should be noted that the forecasts assume constant fracture incidence rates with time. However, small decreases in age-adjusted incidence for hip fracture incidence rates have been observed in recent years in Switzerland [6, 7], potentially rendering the estimates biased upwards.

The cost of osteoporosis (excluding value of QALYs lost) was estimated to rise from CHF 2.1 billion in 2010 to CHF 2.6

billion in 2025, corresponding to an increase of 29 % (Table 16). Costs incurred in women and men increased by 23 and 44 %, respectively.

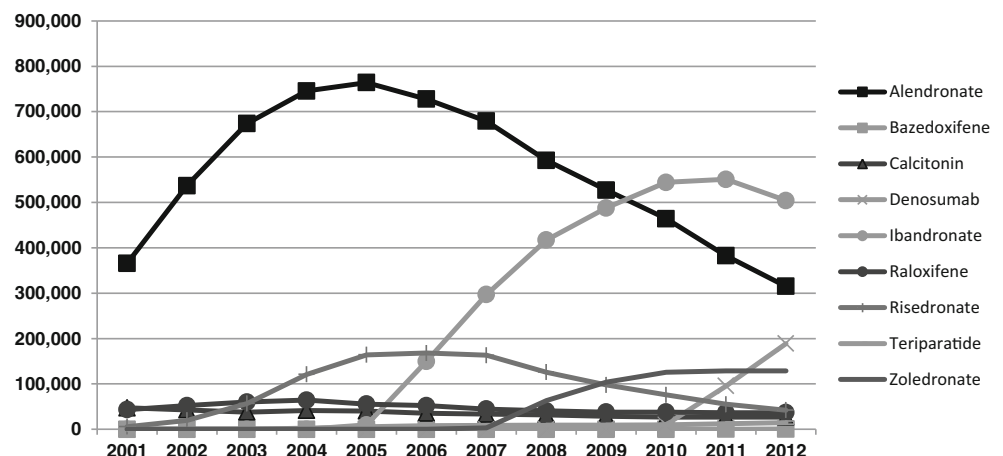
The total number of QALYs lost due to fracture was estimated to rise from 24,000 in 2010 to 29,000 in 2025, corresponding to an increase of 24 % (Table 17). The increase was estimated to be particularly marked in men (36 %) compared to women (18 %). Incident and prior fractures accounted for 64 and 36 % of the increase, respectively.

The cost of osteoporosis including value of QALYs lost was estimated to increase from approximately CHF 5.3 billion in 2010 to CHF 6.7 billion in 2025. The increase was estimated to be particularly marked in men (+39 %) compared to women (+20 %) (Table 18).

### Treatment uptake

To estimate the uptake of individual osteoporosis treatments, sales data from IMS Health (2001–2011) were used to derive the number of defined daily doses (DDDs) sold per 100,000 persons aged 50 years or above (Fig. 2).

Adjusting the sales data for compliance allowed for an estimation of the proportion of the population aged 50 years or above who received any osteoporosis treatment (see Chapter 5 of the report “Osteoporosis in the European Union: Medical Management, Epidemiology and Economic Burden” for further

**Fig. 2** Treatment uptake in Switzerland (defined daily doses [DDDs] per 100,000 persons aged 50 years or above)**Table 19** Number of men and women eligible for treatment, treated and treatment gap in 2010

	Number potentially treated (1,000s)	Number eligible for treatment (1,000s)	Difference (1,000s)	Treatment gap (%)
Men	18	28	10	36
Women	119	286	167	58

details [1]). The proportion of persons over the age of 50 years who were treated increased from 1.7 % in 2001 to 4.9 % in 2011.

### Treatment gap

In order to assess the potential treatment gap, the numbers of men and women eligible for treatment in Switzerland were defined as individuals with a 10-year fracture probability exceeding that of a woman with a prior fragility fracture derived from FRAX<sup>®</sup>, equivalent to a *fracture threshold* (see Chapter 5 of the main report for further details [1]). Subsequently, these estimates were compared to the number of individuals who received osteoporosis treatment obtained from the analysis of IMS Health data. The treatment gaps in men and women were estimated at 36 and 58 %, respectively (Table 19). Note that the estimate of the treatment gap is conservative given that it assumes that current use of osteoporosis treatments is only directed to men and women at high risk.

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**Conflicts of interest** None.

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